
Mapping Solar Potential and Monitoring the Performance of Solar Systems



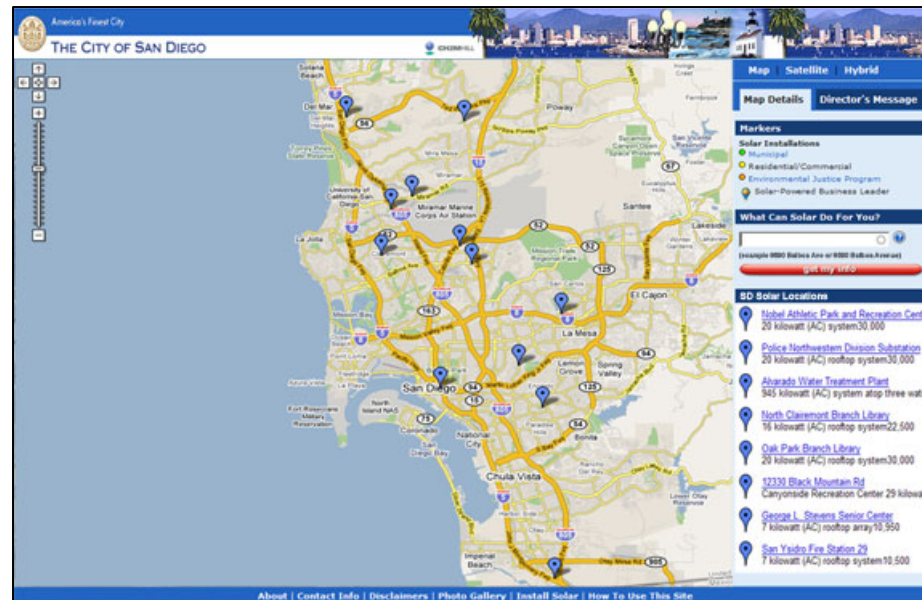
April 15, 2008

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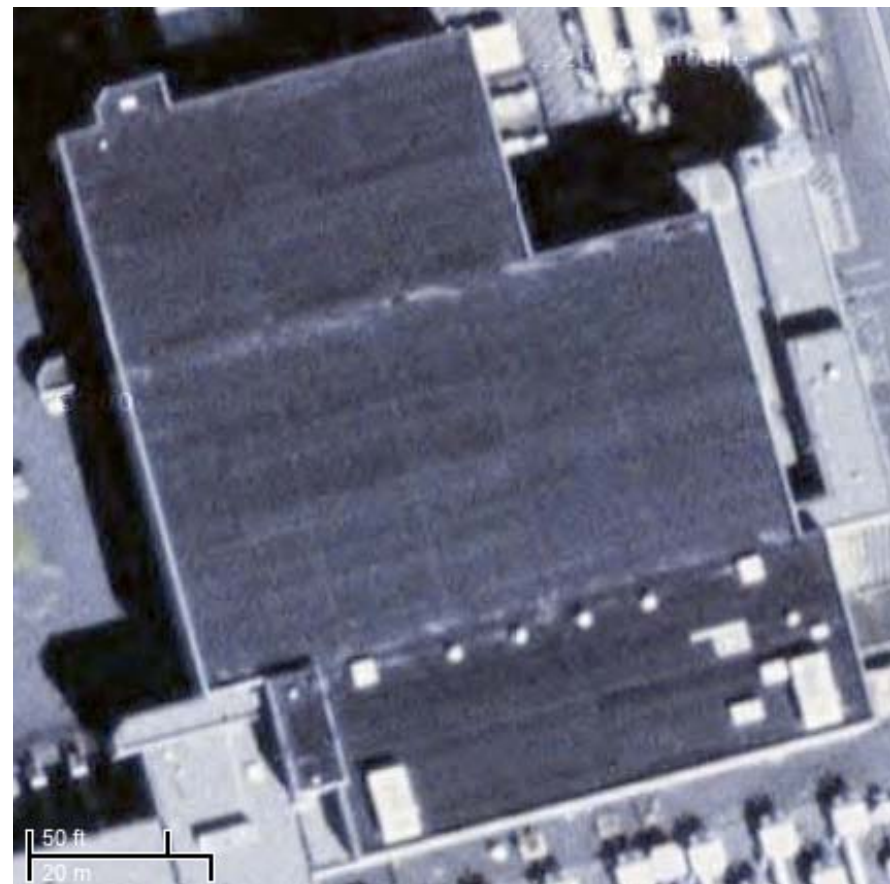
What is Solar Mapping?



➤ Solar mapping is the development of a web based portal that provides users with the ability to see an image of their roof-top and a calculation of the area's Solar PV panel potential



Google Map Images of the Princeton Plasma Physics Laboratory



Analyzing the Potential for an Existing Building



A screenshot of the City of San Diego's solar potential analysis website. The interface shows an aerial view of a building at 8690 Balboa Avenue with a red pin indicating the location. A pop-up window displays the following data:

8690 Balboa Avenue

Roof Size:	1500 sq. ft.
Estimated solar PV potential:	19 - 38 kW
Estimated electricity produced:	34675 - 69350 KWh/yr
Estimated electricity savings:	\$3963 - \$7927 per year
Estimated carbon savings:	25867 - 517354 lbs per year

[Click here](#) for a more detailed estimate

The right sidebar contains the following sections:

- Map Details** | **Director's Message**
- Markers**
 - Solar Installations
 - Municipal
 - Residential/Commercial
 - Environmental Justice Program
 - Solar-Powered Business Leader
- What Can Solar Do For You?**

8690 Balboa Avenue

(example 8880 Balboa Ave or 8880 Balboa Avenue)

[get my info](#)
- SD Solar Facts**
 - Installations:
 - Current: 585
 - 2010 Goal: 10,000
 - Energy produced (MWh):
 - Current: 3,548
 - 2010 Goal: 60,646
 - Annual savings:
 - Current: \$405,514
 - 2010 Goal: \$6.9M
 - CO₂ Reduction (lbs):
 - Current: 2.6M
 - 2010 Goal: 45.2M

A thermometer graphic shows the 2010 goal is 100% and the current status is at 5%.

Footer: [About](#) | [Contact Info](#) | [Disclaimers](#) | [Photo Gallery](#) | [Install Solar](#) | [How To Use This Site](#)

San Diego Solar Locations



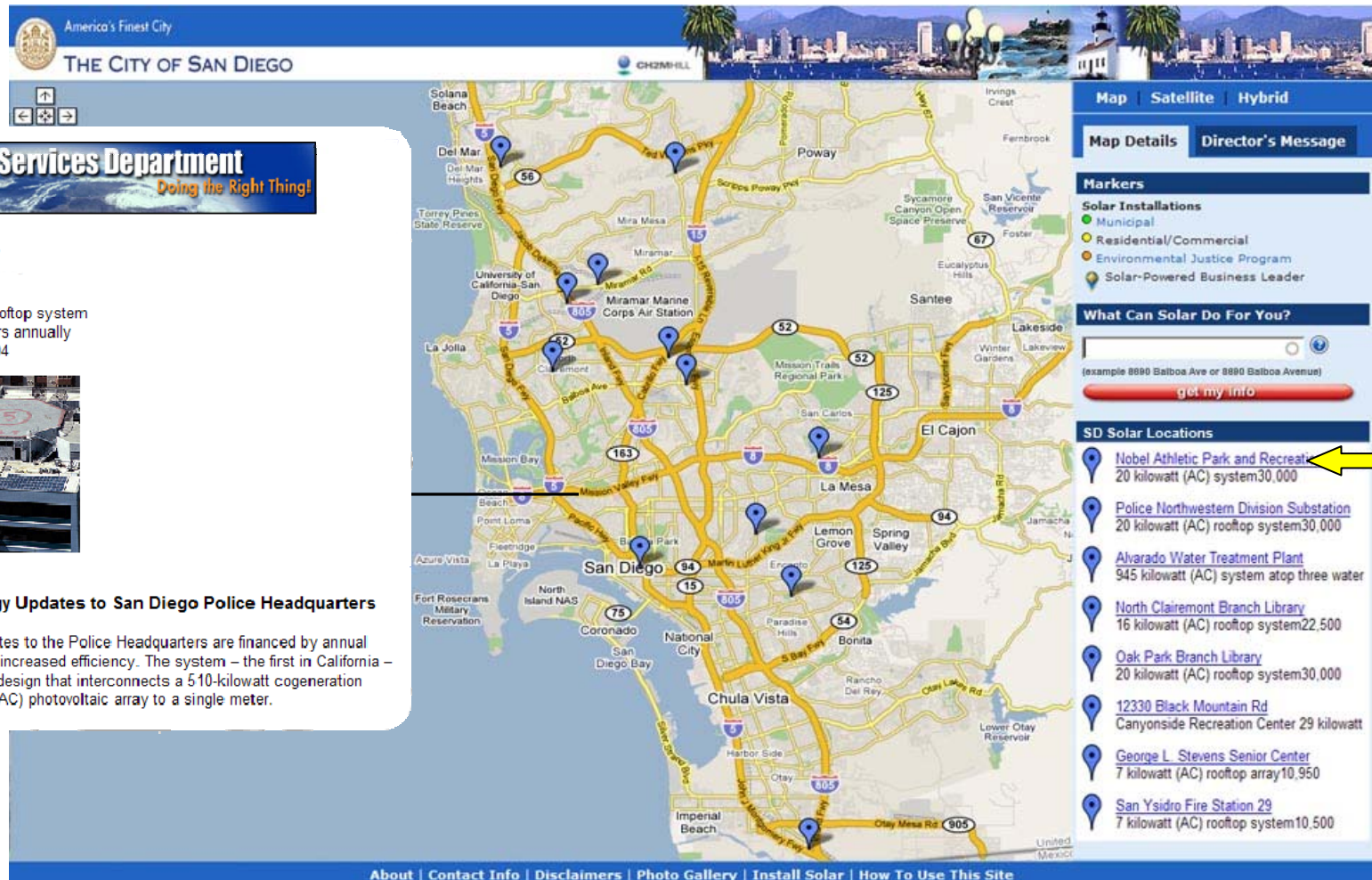
Police Headquarters

- 30 kilowatts (AC) rooftop system
- 45,000 kilowatt-hours annually
- completed June 2004



Savings Pay for Energy Updates to San Diego Police Headquarters

The energy-efficiency updates to the Police Headquarters are financed by annual savings from the building's increased efficiency. The system – the first in California – features a unique "hybrid" design that interconnects a 510-kilowatt cogeneration system and a 30 kilowatt (AC) photovoltaic array to a single meter.



Outline of This Presentation



- Why monitor the performance of solar systems?
- What are the right parameters to measure?
- How do you measure these parameters?
- Who can monitor these systems for you?
- What are the obstacles to data monitoring?

Why Monitor the Performance of Solar Systems?



- System Level

- Determine if the system is working
- Determine the energy production of the system
- Determine when a failure occurs

- Outreach

- Demonstrate to the public how the system works via a kiosk or over the internet

- Policy – Setting Goals

- Benchmark the current renewable energy production
- Determine the role of solar in meeting city goals for using renewable energy or meeting greenhouse gas emissions targets
- Demonstrate to policymakers the impact of solar

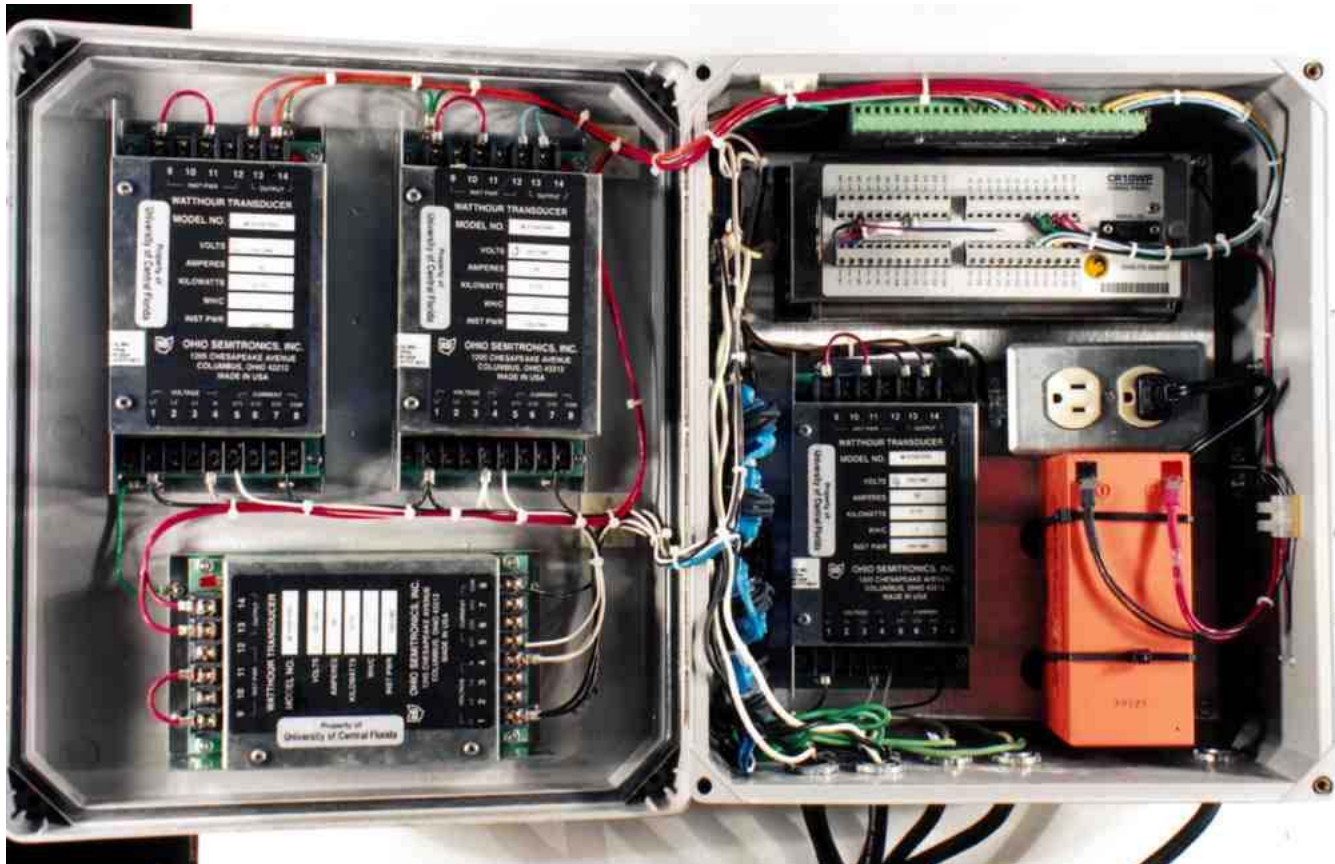
- Example: Long Island Power Authority

What are the right parameters to measure for PV?



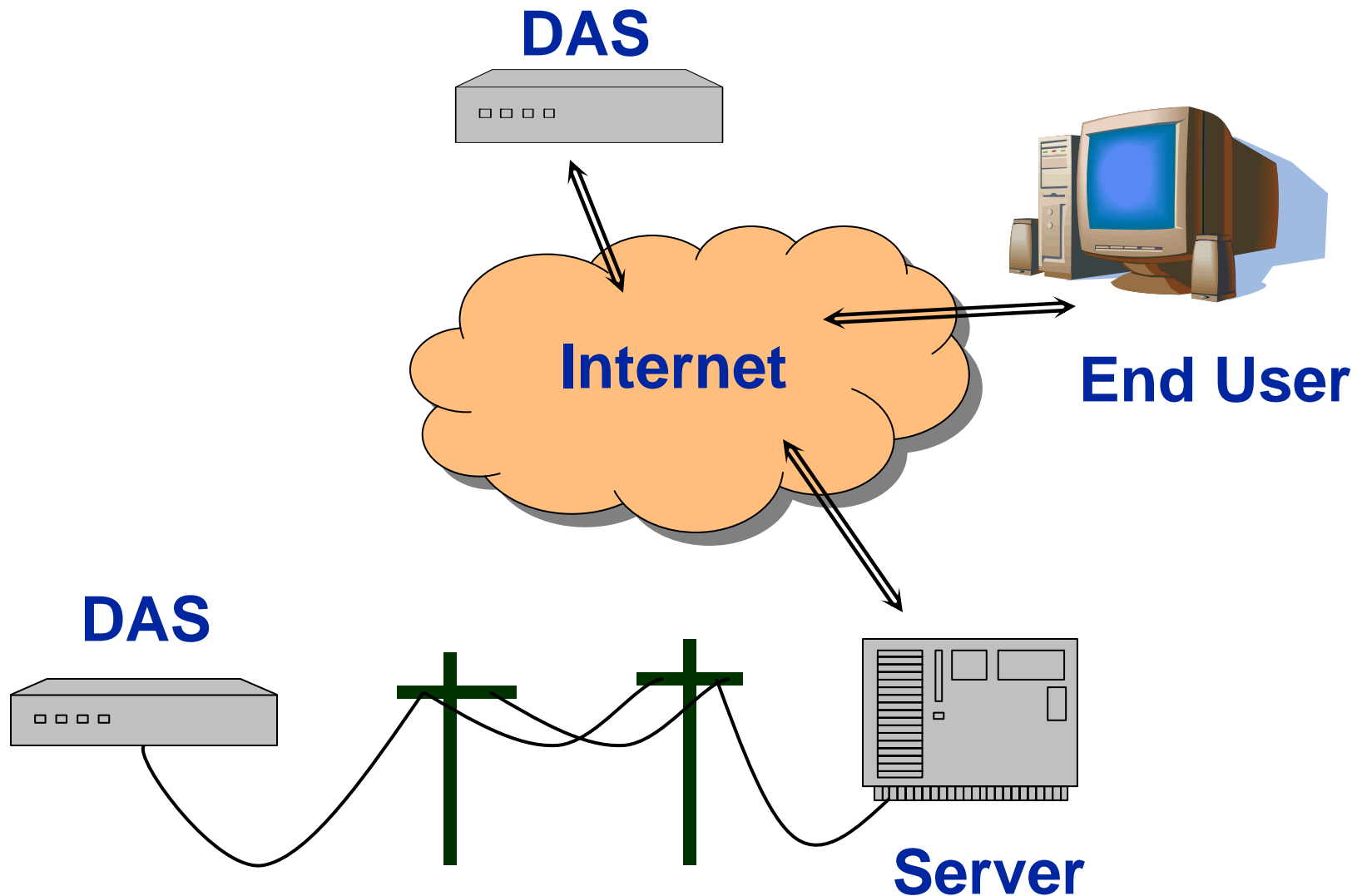
- Photovoltaics
- Most Important Parameter (PV): AC Energy Output (kWh)
- Next Most Important: Solar Irradiation (kWh/m²)
- Other Parameters to Measure
 - DC Voltage (V)
 - DC Current (A)
 - PV Array Temperature (°F)
 - Wind Speed (MPH)
- Solar Hot Water
 - BTU Energy Output – Measure the temperature of the water and the flow rate out of the system or storage tank – the energy used by the hot water heater

Typical Datalogger



How do you measure these parameters?

DAS – Data Acquisition System



Datalogger at the Florida Solar Energy Center



Who can monitor these systems for you?



- Data Monitoring Companies

- Fat Spaniel
- Heliotronics
- Lucid Technologies

- Inverter Companies

- Sunny Boy Web Box and Sunny Portal
- Fronius SolarWeb

- PV Companies

- SunPower will monitor large, commercial systems that they install

Fat Spaniel: City-Wide View



Columbia Solar Technologies

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We are concerned about the environmental legacy we will leave our children. To improve our environment, we are installing and remotely monitoring the performance and production of solar installations throughout northern California. Utilizing an advanced monitoring system, we can quickly diagnose issues before they become problems for the system owner and continue to produce a better future for us all.

Together, these systems constitute a **virtual power plant**, generating clean and reliable renewable energy.

Powered by
Fat Spaniel
TECHNOLOGIES

Roll your mouse over a building below to learn more about PV energy production for that site.



Cumulative Totals

From our main office in Mountain View, we can monitor live data for our residential, commercial, and industrial customers throughout the San Francisco Bay Area.

We receive real-time views of each systems performance as-well-as the cumulative benefits created by such a virtual power plant.

Total Installed PV **86.77 kW**
(as of December 2003)

Output per year **67.38 mWh**

Right Now

1:45pm, 12 Jan 04

Generating **89.4 kW**
Using **45.4 kW**

Energy Production Source

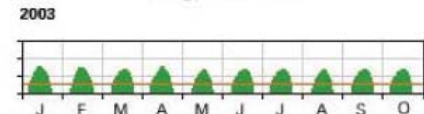


So Far This

[Day](#) [Week](#) [Month](#) [Year](#) [Since Inst.](#)

Generated **82.5 kWh**
Used **83.4 kWh**

Energy Production



[Enlarge](#)

Greenhouse Gases Averted

(Since 02 Dec 2002)

CO₂ **29.3 tons/year**

That is equivalent to:

Making
2,358,200
cups of tea
per year.

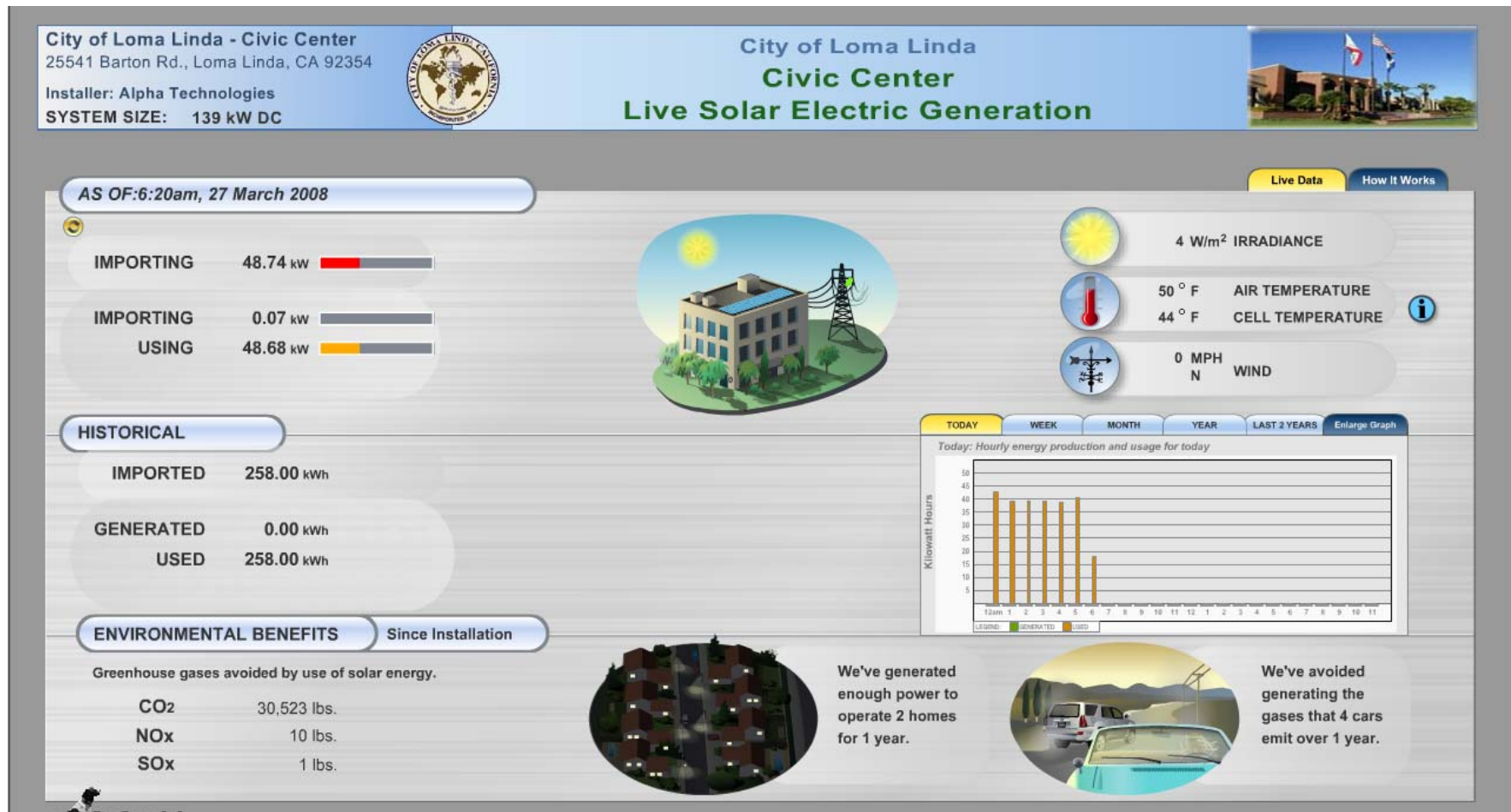


Making
3,806,400
slices of toast
per year.

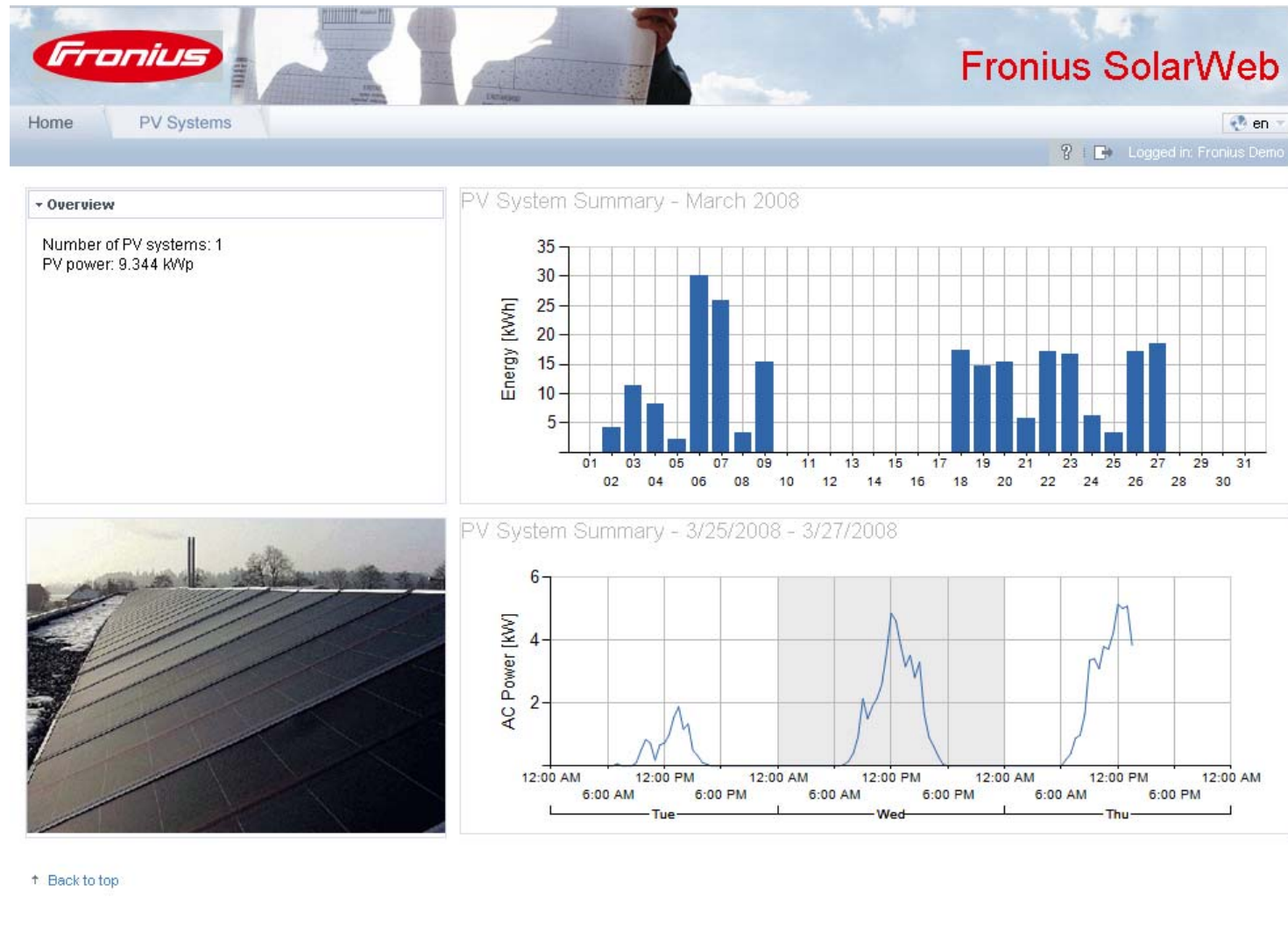


[Learn more](#)

Graphic from Fat Spaniel



Fronius SolarWeb



What are the obstacles to monitoring solar system?



● **Cost**

- *kWh meter* – few hundred dollars, may need to be collected manually
- *Data Acquisition System (DAS)* – Usually over \$1,000, can be several thousand dollars
- *Monitoring over the internet* – usually an ongoing charge to for the vendor to continue collecting the data and presenting it on the internet

● **Maintenance**

- *Calibration*: The data acquisition system needs to be calibrated on a regular basis to ensure the data is correct.
- *Upkeep*: Who will maintain the DAS when problems arise?

● **Communication**

- *Firewalls*: This can be a particular problem when monitor solar systems on school property